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Modeling endosulfan residues in Chinese Soil

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A Gridded Pesticide Emission and Residue Model (GridPERM) has been developed to study pesticide's loading, removal and main exchange processes between different environmental compartments. The model considers four matrixes: air, soil, water, and sediment and includes 2 components: transfer and transport modules. The transfer module describes the changes of pesticide concentrations and its inter-compartmental transfer in multimedia environment using a level-IV fugacity method, and the transport module calculates the mass exchange of pesticide driven by winds in atmosphere using a simple Lagrangian method. The fate of the pesticide in the air, soil, water and sediment is governed by physical and chemical processes within and among these matrixes that are described by the model.

GridPERM has been applied to evaluate emissions to air and residues in soil for endosulfan, an organochlorine pesticide including two isomers, - and -endosulfan in the ratio 7:3. Using Chinese gridded annual usage inventories of endosulfan on a 1/4° longitude and 1/6° latitude resolution (approximate 24 km by 24 km) as input, model outputs included annual mean concentrations in Chinese soil, air, water and sediment.

Modeled soil concentrations of both - and -endosulfan match well with their measured data for 92 soil samples collected cross China in 2005. The Person correlation coefficients are $R = 0.77$ ($p < 0.0001$) for -endosulfan and $R = 0.86$ ($p < 0.0001$) for -endosulfan, validating the usefulness of the model and the accuracy of its output data. The model results show that, the major loss of these two isomers in soil is due to degradation followed by emissions to atmosphere. Soil is primary reservoir of -endosulfan with total burden of 27.7 t, while the total burden of -endosulfan in soil was 8.1 t in 2007, which expected since -endosulfan is more persist in soil and has lower volatile ability than -isomer,